

**NONPROVISIONAL APPLICATION FOR LETTERS PATENT
UNITED STATES OF AMERICA**

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Be it known that I, **ROBERT INDECH**, residing at **4137
Ancient Amber Way, Norcross, Georgia 30092**, a citizen of
10 the United States, have invented certain new and useful
improvements in an

15 **APPARATUS AND METHOD FOR FACILITATING NUCLEAR FUSION**

of which the following is a specification.

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APPARATUS AND METHOD FOR FACILITATING NUCLEAR FUSION

TECHNICAL FIELD

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The present invention relates generally to methods of energy production, and more specifically to an apparatus and method for facilitating nuclear fusion, wherein the present invention is particularly suitable for, although
10 not strictly limited to, facilitating a method of producing controlled hydrogen nuclear fusion on a micro-scale (i.e., hydrogen microfusion), and subsequently harnessing the energy released therefrom.

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BACKGROUND OF THE INVENTION

Fusion power is widely recognized as offering a nearly limitless and inexhaustible future source of energy. Specifically, in view of ever-increasing energy demands,
20 present exorbitant energy consumption, steady depletion of conventional fossil fuel energy sources, and the environmental impact of nuclear fission-based energy production, nuclear fusion energy appears to be the universal panacea to the current energy crisis. Although a

recognizably advantageous energy source, attempts at extracting such nearly limitless amounts of energy from nuclear fusion reactions in a controlled manner, as opposed to "uncontrolled" thermonuclear explosions, has proven an
5 arduous and seemingly unattainable task.

In the typical fusion reaction, a fusion fuel, often composed of mass-2 and mass-3 isotopic hydrogen gas (i.e., deuterium and/or tritium, respectively) must be heated to
10 high temperatures in order to convert the gas into a plasma, or high energy gas, wherein electrically-charged electrons are separated from the positively charged nuclei (i.e., deuterium and/or tritium ions). However, due to the inherent repulsive forces between the positively charged
15 nuclei, the plasma gas must thereafter be heated to extreme temperatures to overcome such repulsive forces and facilitate the fusion process. More specifically, because temperature is a measure of the translational kinetic energy of atoms and nuclei, heating the plasma gas to
20 extreme temperatures results in an increase in kinetic energy of the ions, and thus, the subsequent high-speed collision between the ions sufficient to overcome the repulsive forces therebetween, and permit fusion of the

nuclei. Fusion of the nuclei results in a release of energy. Such an occurrence or method is well demonstrated in the thermonuclear bomb.

5 Accordingly, the goal of controlled fusion research programs is to produce enough fusion reactions to achieve "ignition", and thereby permit the process to become self-sustaining via the continual addition of fusion fuel, whereby heat energy released from the reaction may be
10 conveniently extracted for subsequent conversion into electrical energy. Unfortunately, to obtain such a self-sustaining process, current methods result in more energy being consumed than is produced via the ensuing fusion reaction. Specifically, energy is consumed to heat the
15 initial fusion fuel to plasma, and to subsequently bring the plasma to optimal fusion-inducing temperatures. Additionally, the amount of energy required to maintain the plasma at such a fusion-inducing temperature, and to confine a sufficient quantity of reacting nuclei for an
20 adequate period of time to permit the release of energy, is significantly higher than the amount of energy produced from the fusion reactions. Moreover, a further problem encountered by researchers is the inability to

appropriately and effectively harness the fusion energy released for subsequent conversion into electricity.

Furthermore, although current technology makes
5 deuterium-tritium nuclear fusion feasible, yet still highly energy-consumptive in view of overall energy yield, it is believed that deuterium-deuterium nuclear fusion would effectively be more energy consumptive than a deuterium-tritium nuclear fusion reaction, as higher temperatures
10 would be required to bring the deuterium ion plasma gas to fusion-inducing temperatures.

Although torus-shaped apparatuses having toroidal magnetic fields are currently utilized to confine plasma,
15 and subsequently subject the plasma to extremely high temperatures and pressures for atomic nuclei fusion, such apparatuses are extremely expensive to construct, and still present the problem of requiring more energy to implement the fusion reaction than is released thereby.

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In an attempt to reduce the amount of energy consumption utilized to implement conventional "heat-catalyzed" fusion reactions, many researchers are now

experimenting with other fusion reaction techniques and processes. One such process involves muon-catalyzed fusion between hydrogen nuclei. Specifically, because the muon is much heavier than the electron (i.e., approximately 207
5 times the mass of an electron), its normal orbit is much closer to the nuclei, so the muonic atomic system is much smaller and more tightly bound than its electronic version. The muon effectively shields the repulsive electrical force between the two positively charged nuclei, allowing the
10 nuclei to come together close enough to fuse. The goal of such muon-catalyzed fusion reactions is to induce the muon to catalyze enough reactions for a self-sustaining fusion process. Unfortunately however, often times the muon "sticks" to a charged fusion product, such as an alpha
15 particle (i.e., helium nucleus), and is lost to the cycle. As such, because the muon particle must attempt to catalyze approximately 300 fusions in its average 2.2 microsecond lifetime for a self-sustaining reaction to occur, a muon particle sticking to a charged fusion product obviously
20 results in cessation of the fusion process, and thus, the non-occurrence of a self-sustained or "ignited" fusion reaction. Furthermore, the conventional method of producing muon particles in a particle accelerator requires

more energy for production than is derived from the subsequent hydrogen fusion reactions prior to loss of the muon particle.

5 Still others have attempted, with measurable and observable success, albeit controversial, the fusion of nuclei at room temperature. Coined "cold fusion", the process involves the low-voltage electrolysis of heavy water, utilizing platinum, palladium or titanium electrodes
10 onto which deuterium nuclei are said to concentrate at very high densities. Although certain results have shown the cold fusion reaction to yield excess or "latent" heat, attempts to duplicate or reproduce experimental results for producing a self-sustaining fusion reaction have not been
15 successful. Unfortunately, only theories exist to explain the shortcomings of the cold fusion process, leaving researchers of different schools of thought (i.e., those utilizing extreme temperatures and pressures to catalyze fusion) to discount, albeit arguably prematurely, the
20 potential and possibility of such cold fusion reactions and processes. Additionally, although it is recognized that the availability of an effective reacting surface and the ability to immediately remove reaction-generated energy is

crucial in the success and potential reproducibility of cold fusion reactions, current reacting surfaces utilized in the cold fusion process quickly disintegrate, either as a result of structural deficiencies of the reacting surface
5 utilized and/or the delayed capture of energy released from the reaction. Disintegration of the reacting surface often results in the formation of pits and/or craters therein, and thus, the cessation of the reaction process. Moreover, as no effective method is available for the rapid removal
10 of energy from the reacting surface, disintegration of conventional cold fusion reacting surfaces is seemingly inevitable. Additionally, there is considerable controversy as to the exact method of surface preparation, thus leading to non-reproducibility of results.

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Nonetheless, it is incontrovertible that fusion, in general, does occur, as is amply evidenced in the operation of the thermonuclear bomb.

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Therefore, it is readily apparent that there is a need for an apparatus and method for facilitating nuclear fusion, wherein micro-scale, controlled hydrogen nuclear fusion is effectuated without the introduction of extreme

temperatures and pressures, and wherein the utilization of a geometrically-enhanced reacting surface induces and/or facilitates multiple near room temperature fusion reactions thereon and thereover, thus providing the requisite
5 reaction "ignition" for a self-sustaining fusion reaction process. There is a further need for an apparatus and method for facilitating nuclear fusion that provides for the rapid collection of energy released from fusion reactions for subsequent conversion of same into useful
10 energy sources.

BRIEF SUMMARY OF THE INVENTION

Briefly described, in a preferred embodiment, the
15 present invention overcomes the above-mentioned disadvantages and meets the recognized need for such a device by providing an apparatus and method for facilitating nuclear fusion, wherein micro-scale, controlled hydrogen nuclear fusion is promoted on and over
20 a geometrically-enhanced reacting surface comprising a plurality of cone-shaped structures extending therefrom, and wherein the "multi-cone" reacting surface is manufactured from a suitable material having a particular

affinity for deuterium ions to preload themselves thereon and between the lattice interstices thereof. The present invention contemplates that fusion between deuterium nuclei may be promoted on the reactive multi-cone surface not with
5 the conventional application or introduction of extreme temperatures and pressures thereover, but instead through the effective cancellation or electron shielding of the positively-charged repulsive forces between two deuterium nuclei located near the tips of each cone structure (i.e.,
10 preloaded within the lattice interstices thereof). As such, an electron source supplies a sufficient quantity of free electrons to effectively shield the positively charged reacting deuterium nuclei, and thus permits fusion between same.

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However, to produce and concentrate a net charge density sufficient to provide the requisite shielding to overcome the repulsive forces and permit nuclear fusion of the two nuclei at preferably room temperature, a potential
20 is applied over the deuterium-preloaded reacting surface, wherein elementary electrostatics dictates the accumulation or concentration of free electrons proximal to the tip of each cone structure extending from the reacting surface.

That is, the cone tips, in the presence of an applied potential, function as active lattice site electron concentrators that provide the requisite net charge density sufficient to shield the positively-charged repulsive forces of two deuterium nuclei positioned at the tip of a selected cone, thereby permitting the fusion between same.

As such, within the presence of an applied potential and free electrons, a plurality of such deuterium-preloaded cone-shaped structures advantageously facilitates multiple room temperature fusion reactions, thus providing the requisite reaction "ignition" for a self-sustaining fusion reaction process.

It is further contemplated that the heat energy released from such multiple fusion reactions (i.e., chain-reactions) may be captured via an ultra-thin membrane on a heat exchanger, wherein the heat energy would be siphoned-off as heat energy and converted to conventional electrical energy sources.

Accordingly, a feature and advantage of the present invention is its ability to promote fusion reactions

without conventional application of extreme heat and pressure.

Another feature and advantage of the present invention
5 is its electron-catalyzed fusion reaction.

Still another feature and advantage of the present invention is its geometrically-enhanced reacting surface that comprises a plurality of cone-shaped or wedge-shaped
10 structures that, within the presence of an applied potential and free electrons, function as active lattice site electron concentrators that provide the requisite net charge density sufficient to shield positively-charged repulsive forces of two deuterium nuclei positioned near
15 the tip of a selected cone, thereby permitting the fusion between same.

Yet another feature and advantage of the present invention is its geometrically-enhanced reacting surface
20 that comprises a plurality of cone-shaped or wedge-shaped structures that advantageously facilitate multiple room temperature fusion reactions.

Yet still another feature and advantage of the present invention is the application of elementary electrostatic principles and teachings that provide a reacting surface capable of promoting a net charge density sufficient to
5 provide the requisite electron shielding necessary to permit nuclear fusion at room temperature, or other given temperature.

A further feature and advantage of the present
10 invention is its ability to release more energy than is consumed or applied to promote the fusion reaction.

Still a further feature and advantage of the present invention is its ability to permit the capture of heat
15 energy for conversion of same into electricity.

Yet still a further feature and advantage of the present invention is its ability to promote or ignite a self-sustain fusion reaction.

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Still another and further feature and advantage of the present invention is its ability to resolve the above-described problems and deficiencies associated with muonic-

catalyzed fusion reactions via the application of elementary electrostatic principles, electron screening principles, and a deuterium-preloaded charged lattice structure (i.e., charged multi-cone reacting surface).

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These and other features and advantages of the present invention will become more apparent to one skilled in the art from the following description and claims when read in light of the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be better understood by reading the Detailed Description of the Preferred and
15 Selected Alternate Embodiments with reference to the accompanying drawing figures, in which like reference numerals denote similar structure and refer to like elements throughout, and in which:

20 **FIG. 1** is a perspective view of a reacting surface according to a preferred embodiment of the present invention;

FIG. 2 is an illustration detailing the geometry of a reacting surface according to a preferred embodiment of the present invention; and,

5 **FIG. 3** is a perspective view of a reacting surface according to an alternate embodiment of the present invention.

10 **DETAILED DESCRIPTION OF THE PREFERRED**
 AND SELECTED ALTERNATIVE EMBODIMENTS

15 In describing the preferred and selected alternate embodiments of the present invention, as illustrated in **FIGS. 1-3**, specific terminology is employed for the sake of clarity. The invention, however, is not intended to be limited to the specific terminology so selected, and it is to be understood that each specific element includes all technical equivalents that operate in a similar manner to accomplish similar functions.

20 As addressed above, a muon particle is characterized by a negative charge equal to the electron, but is approximately 207 times the mass of an electron. As such,

the normal orbit of a muon is much closer to the nuclei than an electron. Therefore, scientists have determined that substitution of the electron in a deuterium atom with a muon particle will allow nuclear fusion to occur at room
5 temperature. That is, the muon effectively shields the repulsive electrical force between the two positively charged nuclei, allowing the nuclei to come together close enough to fuse.

10 More specifically, quantum mechanics predicts, and experiments confirm, that the ionization of the ground level electron in the hydrogen atom is -13.6 electron volts (eV). For the muonic deuterium atom, the muon ionization value is $200 \times -13.6 = -2720$ eV. The mean radius for the
15 electron in the hydrogen atom, termed the Bohr radius, is 5.3×10^{-11} meters, and for the muonic deuterium atom is $5.3 \times 10^{-11} / 200 = 2.6 \times 10^{-13}$ meters. As such, the lower radius of the muon increases the electronic screening, and thus radically lowers the critical temperature required for
20 fusion by approximately a factor of 10^5 .

Unfortunately however, often times the muon "sticks" to a charged fusion product, such as an alpha particle

(i.e., helium nucleus), and is lost to the cycle. As such, because the muon particle must attempt to catalyze approximately 300 fusions in its average 2.2 microsecond lifetime for a self-sustaining reaction to occur, a muon
5 particle sticking to a charged fusion product obviously results in cessation of the fusion process, and thus, the non-occurrence of a self-sustained or "ignited" fusion reaction. The energy conventionally required to produce the muon particle exceeds the energy gained from the
10 hydrogen fusion reactions it catalyzes.

Accordingly, instead of utilizing muon-dependent or muon-catalytic processes to induce fusion reactions, the present invention preferably contemplates utilizing
15 electron screening to promote nuclear fusion between deuterium nuclei at room temperature. As more fully described below, the present invention effectively defines formulae for determining the effect of electron screening on reacting nuclei, and thus solves for the muonic
20 equivalent of electron shielding with only electrons present before the reacting nuclei, thus permitting nuclear fusion of same at room temperature.

It is known that for an atom with a low atomic number, as the atomic number increases, the ionization energy for the innermost electron increases as the square of this number. To remove all electrons from the atom, the ionization energy for the entire atom must also include corrections for electron-electron interaction. For the isolated atom, any electrons greater than two will assume higher energy outer orbitals than the two innermost electrons in the "s" orbitals. Such higher energy outer orbitals are conventionally referred to as "p", "d", and "f", wherein electrons residing therein require substantially less energy to ionize than the electrons within the "s" orbital.

For the isolated deuterium atom, although charged, the effect of electron screening on the approaching second deuterium ion will be minimal, wherein the distance of the second deuterium ion to the primary deuterium nucleus is within the innermost electron orbital. However, because an electron is not a rigid particle, the Heisenberg uncertainty principle must be considered, and thus the exact position of the electron may at some time be quite close to the nucleus, allowing sufficient screening to

reduce the critical temperature for fusion. Clearly, the probability of close nuclear screening increases as the number of electrons circulating about the atom increases. Quantum tunneling must also be accounted for, as when the second deuterium nucleus effectively "tunnels" through the critical energy barrier to fuse with the first deuterium nucleus. Again, the probability of occurrence of the tunneling effect increases with increasing electron density around the atom.

10

However, for lattice charges that do not attach to the deuterium ion, but rather attach to the lattice atoms, electrons may have a substantial probability of being close to the deuterium nucleus. To determine the relationship between electron mass, m , valence, Z , and ionization energy, E_n , the following equation (1) is preferably utilized:

15

$$E_n = m * Z^w * E_{no}$$

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wherein E_n is the univalent ionization energy, and wherein w is an undetermined coefficient. For the isolated deuterium atom, w may be equal to 0.5, while for the model

of screening due to lattice charges, w may be equal to 3. It is suggested that an intermediate situation results when w is equal to 2. For the muonic deuterium atom, the ionization energy increases by a factor of approximately 200 due to the inherent muonic mass, but one may solve for the muonic equivalent of electronic shielding, Z_{equiv} , with only electrons present, wherein the following equation (2) is preferably utilized:

$$E_{\text{no}} * m_{\text{muon}} * 1^2 = E_{\text{no}} * m_{\text{electron}} * Z_{\text{equiv}}^2$$

Solving for Z_{equiv} yields a value of 14.4 electron equivalents to shield to muonic level to allow room temperature fusion. The concept of an isolated single proton atom with 14 circulating electrons grossly violates electric neutrality principle and is not found isolated in nature.

For practical purposes, the final magnitude of the strong nuclear force does not depend on the type of nucleon involved, nor the proton or neutron, but rather the number of independent nucleon-nucleon interactions present. For a hydrogen-hydrogen combination, there is one strong nuclear

attractive force acting; for a deuterium-deuterium combination, there are four; and for a tritium-tritium combination, there are nine. Whether one considers the simple nuclear model or the overlapping nucleon quantum mechanical wave, the maximum of the strong nuclear forces require a net minimization of the nucleon separation distance for all nucleons, mediated by the form of the nuclear attraction force.

In determining an equivalence method for hydrogen fusion, a simple mathematical model of the hydrogen fusion temperature, the number of strong nucleon interactions and the number of equivalent electrons is preferably constructed as follows:

$$\text{Equation (3): } \log(T) = a_0 * n_e + a_1 * n_n + a_2$$

wherein T is temperature, n_e is the number of equivalent electrons, n_n is the number of strong nucleon interactions, and a_0 , a_1 , and a_2 are undetermined constants. However, the a_0 , a_1 , and a_2 constants may be solved mathematically from placement of experimentally determined data in the following matrix formulation (4):

$$\log \begin{pmatrix} 3*10^2 \\ 3*10^6 \\ 3*10^7 \\ 3*10^8 \end{pmatrix} = a_0 * \begin{pmatrix} 14.4 \\ 0 \\ 0 \\ 0 \end{pmatrix} + a_1 * \begin{pmatrix} 4 \\ 9 \\ 4 \\ 1 \end{pmatrix} + a_2 * \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

Solving the above matrix equation (4) yields a least
5 squares solution of $a_0 = -0.8256$, $a_1 = -0.5639$, $a_2 = 19.85$

The above formula is preferably utilized to calculate
the required temperature for fusion with a given neutral
atom type (hydrogen, deuterium or tritium), or to calculate
10 the excess local charge density required at a specific
temperature and ion type. Implicit within this model is
the assumption of equivalence of fusion probability with
equivalence of total electron ionization value.

15 For example, for 1000° Kelvin deuterium-deuterium (D-D)
fusion, the increase of electron local charge density, n_{ei} ,
over the two deuterium atoms normal charge density is given
by solving equation (3) with $n_{ei} = n_e - 2$, $T=1000$, $n_n=4$, thus
yielding $n_{ei}=10.94$, or 11 extra equivalent electron charges

per molecule for deuterium-deuterium fusion to occur at near room temperature.

In order for deuterium-deuterium fusion to occur via
5 the above-referenced electron shielding technique, an appropriate, highly charged reacting surface must be made available. As such, the present invention preferably provides a geometrically-enhanced surface to assist in the production of a net charge density sufficient to shield the
10 positively-charged repulsive forces of two deuterium nuclei; thus, permitting the room temperature fusion between same.

More specifically, and with pertinent reference to
15 **FIG. 1**, the present invention in its preferred form contemplates the construction of a reacting surface **10** preferably having a plurality of spaced-apart cones **20** extending therefrom, and integrally formed therewith. Such a "multi-cone" reacting surface **10** preferably functions to
20 facilitate the production of a sufficient net charge density required for effective shielding to permit nuclear fusion at a given temperature (i.e., preferably room temperature). The following presentation of electrostatic

principles is provided to facilitate an understanding of the geometric contribution of reacting surface **10** and cones **20** in the fusion process.

5 With specific reference now to **FIG. 2**, depicted therein is an illustrative representative of the geometry and charge density development of the present reacting surface **10** and associated cones **20**. Two surfaces are illustrated, inner cone **A** and outer cone **B**, preferably
10 disposed in a cone-within-a-cone relationship. Preferably, outer cone **B** may be considered a flat plate by setting the angle θ_2 to $\pi/2$ degrees.

Consider now that the surfaces of cones **A** and **B** are
15 extremely close at the vertexes thereof, but are preferably not touching. Cone **A** is preferably defined by angle θ_1 , wherein the position along the surface of cone **A** is preferably defined by a variable r , measured from the mathematical point of surface intersection. Additionally,
20 cone **B**, or the flat plate, is preferably set as potential $\phi = 0$, wherein cone **A** is preferably set as potential $\phi = V_1 = V_0$.

Preferably, no free charges exist within space **C** between cone **A** and cone **B** (flat plate); thus, the distribution of potential within space **C** is governed by
5 Laplaces' equation: $\nabla^2\phi = 0$.

Working in cylindrical coordinates, and taking advantage of the radial symmetry of the problem, preferably permits the solution of Laplaces' equation in terms of the
10 arbitrary test angle θ , wherein the solution is preferably given in the following equation (5), valid in the region $\pi/2 \geq \theta \geq \theta_1$:

$$\text{Equation (5): } \phi = V_0 * \left(\frac{\ln(\tan(\theta/2)) - \ln(\tan(\pi/4))}{\ln(\tan(\theta_1/2)) - \ln(\tan(\pi/4))} \right)$$

15

Clearly, equation (5) satisfies the constraints. The vector electric field, \vec{E} , is determined in these cylindrical coordinates by equation (6) below. The vector displacement field, \vec{D} , is determined in the vacuum by
20 equation (7) below. On the conductor surface, the scalar

charge density, ρ_s , is equal to the normal component of the displacement field, as given in equation (8) below.

Equation (6): $\bar{E} = - 1/r * d\phi/d\theta$

5 Equation (7): $\bar{D} = \epsilon_0 * \bar{E}$

Equation (8): $\rho_s = D_N$

Solving the above model for the charge density yields equation (9):

10

$$\rho_s = \left(\frac{-\epsilon_0 * V_o}{r * \sin(\theta_1)} \right) * \left(\frac{1}{\ln(\tan(\theta_1/2)) - \ln(\tan(\pi/4))} \right)$$

It is recognized, as a peculiarity of the geometry of cones 20, that the charge density may become infinite at the tips thereof. Setting a potential V_o , and a given geometry θ_1 , cone 20 may reach any charge density a certain critical distance from the tip thereof, and will exceed this charge density from such a critical distance to the tip. In practical construction, the tip of cone 20 will be a single atom and not infinitely sharp, and thus charge density will be finite. Further, the dielectric constant

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will be increased due to the presence of the gas in the previously defined vacuum.

With reference to **FIG. 3**, the geometry leading to a
5 (1/r) charge relationship may also be considered as a two-dimensional equivalent of cone **20** (i.e., the sharp triangle), extended into three dimensions as a sharp wedge **120**. Thus, a reacting surface may alternatively be constructed as a plurality of sharp wedges **120** on a planar
10 base **130**, wherein each wedge **120** could possess active lattice site electron concentration areas **122** to equally effectively facilitate the present cold fusion method described herein.

15 To illustrate application of the above formulae, and in consideration of surface **10** and associated cones **20**, if one considers a 2 angstrom spacing between adjacent conductive surface atoms in cone **20**, then 12.2 electrons as excess charge density per atomic spacing would yield a
20 required surface charge density of ρ_s as 19 coulombs/square meter of surface. For a cone angle θ_1 of 5 degrees, and a 5000 volt applied potential, the critical distance from the

tip of cone **20** would be 8.5×10^{-9} meters, and the total tip surface area available to promote fusion would be 2×10^{-17} square meters, thus representing 495 atomic lattice sites per cone **20**.

5

It should be recognized that although **FIG. 1** illustrates a plurality of cones **20**, and **FIG. 3** a plurality of wedges **120**, for efficient operation of the present invention, only one cone **20** or wedge **120** is required for
10 the fusion reaction to occur. Additionally, it should be noted that the mathematical derivation for the concentration of charge is idealized and assumes no physical distance between the peaked surface (i.e., tip of cone **20**) and the reference ground plane. In reality,
15 however, a separation distance will exist, albeit finite, and thus lead to a charge density solution that does not quite vary as $(1/r)$. However, minimization of this separation distance, coincident with maintaining an ionized gas in the interval, but not allowing arc-over between the
20 peaked surface and the reference ground plane, will still give an approximate $(1/r)$ character.

The present invention contemplates that fusion will preferably only occur on the surface layer of atoms constructing cone **20**, and further that the material selected to construct cones **20**, and/or surface **10** in general, would preferably possess an affinity for deuterium to preload itself within the lattice interstices of each surface lattice site before a potential is applied thereacross. Such materials may include, for exemplary purposes only and without limitation, platinum, palladium and/or titanium, each of which are excellent hydrogen (proton) acceptor surfaces, thereby allowing substantial loading of the deuterium gas within the metallic matrices/interstices thereof. Additionally, utilization of surface **10** and associated cones **20** as active lattice site electron concentrators preferably requires that the deuterium first be ionized, so as to permit interaction (i.e., preloading) of same with cones **20**. Thereafter, the tips of cones **20**, in the presence of an applied potential and free electrons (i.e., from a suitable electron source), function as active lattice site electron concentrators that provide the requisite net charge density sufficient to shield the positively-charged repulsive forces of two deuterium nuclei positioned at the tip of a selected cone

20, thereby permitting the fusion between same, as more fully described below. It should be recognized that a plurality of such deuterium-preloaded cones 20 would advantageously facilitate multiple room temperature fusion reactions, thus providing the requisite reaction "ignition" for a self-sustaining fusion reaction process.

Referring back to FIG. 1, the complete reacting surface 10 would preferably be constructed as a regular number of spaced cones 20, wherein the reacting surface of each cone 20 preferably ends in a point, or practically, in a small number of atoms at the tip of each cone 20. The underlying base of surface 10 may be macroscopically curved with little effect on the charge concentrator effect.

15

Additionally, reacting surface 10 and associated cones 20 must preferably be manufactured from a conductive material. As such, although metallic compositions are not necessarily required for construction of reacting surface 10 and cones 20, the atomic binding of the selected material must be sufficient to maintain its own internal structure in the presence of extremely high excess charge accumulation.

It is further preferred that the number of such cones
20 or peaks be proportional to the number of reactive sites
for the fusion to occur, and in proper design, would
5 preferably be maximized per square base area over surface
10. As such, one may consider that each cone 20 comprises
a preferred minimum height to base width ratio of 10 to 1.
For example, for a 10 to 1 ratio for total cone 20 height
to critical distance, and dense packing of cones 20 over a
10 planar surface, one could place 1.2×10^{13} peaks on a simple
3 cm by 3 cm flat or planar surface. Current
nanotechnology processing techniques could effectively
permit construction of such a surface 10.

15 In the foregoing example, a single burst of energy
output for 6×10^{15} reactions (i.e., 495 atomic lattice
points multiplied by 1.2×10^{13} peaks on a 3 cm by 3 cm
planar surface) for deuterium fusion is 144 kilojoules,
utilizing a mass of 4×10^{-8} grams of deuterium. The burst
20 rate is preferably controlled by electronics in the control
circuit, the deuterium replenishment rate, and the
availability of the reacting surface.

If a higher value of electron equivalents is required, then less sites per peak are available for fusion. Surface 10 would then be less efficient in the number of fusion reactions per unit area, but reactions would still occur. 5 Thus, an error in the calculation of the "w" exponent in Equation (1) above would still allow the technique to work.

It should be recognized that cones 20, and surface 10 in general, utilized for producing high local charge 10 density to facilitate room temperature fusion, are not limited to hydrogen fusion alone. Such a charge density could be utilized to create local conditions for fundamental particle generation by injection of higher order atomic nuclei onto surface 10, thereby allowing 15 nuclear combination, and capturing the secondary particles generated thereby. With very rapid heat capture, surface 10 and associated cones 20 could be constructed as an ultra-thin membrane on a heat exchanger, wherein most of the fusion energy could be siphoned-off as heat and 20 subsequently converted to electricity.

Moreover, with the present reaction surface 10 in general, injection of a mix of higher number atomic nuclei

(such as carbon, etc.) after the system has been deuterium loaded would effectively permit nuclear transmutation. Such an alternate application could be very energy efficient, as the voltage fields are electrostatic in nature, and thus, consume little power except that utilized by the nuclear combination.

Although deuterium is the preferred primary fuel utilized to implement the present method of fusion, it should be recognized that the present method, and reacting surface **10** in general, could be utilized to fuse nuclei of atomic elements having higher atomic numbers than isotopic hydrogen.

15 Additionally, although near room temperature is contemplated to effectuate the present fusion method via utilization of the preferred and/or alternate embodiments of reacting surface **10**, it should be recognized that a multitude of suitable temperatures could alternatively be
20 utilized in conjunction with the various embodiment of reacting surface **10** to facilitate nuclear fusion between isotopic hydrogen and/or other suitable atomic elements having higher atomic numbers.

It should be recognized that the critical distance calculated for the tip of cone 20 is an average, and that the utilization of deuterium atoms with kinetic energies in excess of the average temperature-dependent kinetic energy, will increase this effective critical distance, thereby considerably adding to the number of active reaction sites.

It should further be recognized that the influence of electron shielding is not limited to deuterium-deuterium fusion reactions alone. That is, because the ignition temperature of a tritium-tritium reaction is over a factor of ten less than the ignition temperature of a deuterium-deuterium reaction, many more sites would be active for a tritium-tritium reaction on a surface 10 having the same geometry and charge density as a surface 10 utilized to promote a deuterium-deuterium reaction. However, due to ready availability of deuterium (i.e., occurring naturally in approximately 1 part in 6000 parts of ordinary water), and in view of the difficulty and tight regulation involved in the manufacture of tritium gas (i.e., a highly poisonous gas), deuterium is the preferred reaction fuel. It is further contemplated that a deuterium and tritium gas mix could be utilized as the reaction fuel in implementing the

present fusion method, wherein the gas mix could preload on surface **10** and associated cones **20** (or wedges **120**) prior to applying a potential across same.

5 It should still further be recognized that the geometry of surface **10** does not necessarily have to comprise the rigid cone-shape of cone **20**, nor does planar base **130** necessarily have to comprise the rigid wedge-shaped of wedge **120**. That is, surface **10** could be sharply
10 pointed, comprise any selected number of protrusions, wherein each such protrusion would comprise an apex, or, alternatively, could be in the form of a sharply pointed structure or protrusion in general. Cones **20** and wedges **120** are, respectively, 3-dimensional and 2-dimensional
15 idealizations of the sharply-pointed geometric characteristic that surface **10** should preferably embody to facilitate the present fusion method. Accordingly, the charge density derived from the solution of Laplace's equation of electrostatics does not necessarily have to
20 comprise an exact $(1/r)$ character, just a dominant $(1/r)$ character that can be attained in a sharply-pointed geometry of surface **10**. Fabrication of such a surface **10** comprising a sharply-pointed geometry or micro-peaks in

general, could be facilitated via semi-random growth of metal dendrites on surface 10 via a conventional electroplating apparatus. As such, neither the regularity of such micro-peaks, nor the spacing of same, would be
5 critical to a fusion reaction. However, competent engineering practice would attempt to maximize the number of active peaks or sites per unit surface area. Alternatively, fabrication of such micro-peaks, or cones 20 and/or wedges 120, could be facilitated via suitable
10 nanotechnology processes and apparatuses.

It should also be recognized that not only is the sharply-pointed characteristics or shape of reacting surface 10 important, but also that there exist an
15 electrically neutral plane in very close proximity to reacting surface 10, but not touching same, with hydrogen gas (or isotopes thereof) between reacting surface 10 and the electrically neutral plane, and that there be sufficient electrical potential difference between reacting
20 surface 10 and the electrically neutral plane so as to achieve the necessary reacting conditions set forth herein.

Having thus described exemplary embodiments of the present invention, it should be noted by those skilled in the art that the within disclosures are exemplary only, and that various other alternatives, adaptations, and modifications may be made within the scope of the present invention. Accordingly, the present invention is not limited to the specific embodiments illustrated herein, but is limited only by the following claims.